



U.S. Department of Transportation
Federal Aviation Administration

Aeromedical Research Resume

Research Project Initiative Subtask for FY01

1. Title:
Clinical Research in Support
of Aircraft Accident Analyses

2. Sponsoring Organization/Focal Point:
AAI-1: Steven B. Wallace
AAM-1: Jon L. Jordan M.D.

3. Originator Name, Organization:
Dennis V. Canfield, Ph.D.
AAM-610, FAA, CAMI
(405) 954-6252

4. Origination Date: August 2000
Start Date: Oct. 1, 2000

5. Parent RPI Number:
3

6. Subtask Number:
AM-B-00-TOX-203

7. Completion Date:
September 30, 2003

8. Parent MNS:
Aeromedical Research (159)

9. RPI Manager Name, Organization, Phone:
James E. Whinnery Ph.D., M.D.
AAM-600, FAA, CAMI
(405) 954-4808

10. Research Objective(s):

To conduct research involving current aerospace medicine problems affecting flight safety in the National Aerospace System.

To maintain an aeromedical research response team for aircraft accidents to support FAA and NTSB accident investigations and to conduct research for safety recommendation development.

To collect and preserve aeromedical safety data in a database of mishaps and pilot incapacitations of relevance to clinical decision making in the Office of Aviation Medicine. Data will be evaluated from aircraft accident investigation and incident systems (FAA, DOD, NASA, and NTSB) as well as collected from on-scene or consultative participation with FAA, NTSB, and other national and international sources.

To maintain medical epidemiological databases that allow data driven decision making regarding clinical topics of relevance to the FAA such as: comparison of FAA medical certification with international practices, policies on special issuance of airman certification, certification requirements for pilot vision, eye protection from lasers, pilot incapacitation incidence data, in-flight medical care provision, airline medical kits, crashworthy and cabin safety survival factors, and other bioaeronautical concerns.

To enhance the FAA mission by participating in research concerning aircraft survival factors and determining the predominant effects that occur in the postcrash environment.

To enhance the FAA mission by conducting research involving vision factors of importance to pilot certification and aviation safety.

To enhance the FAA Human Factors Plan by participating in research involving aerospace human factors and elucidating the aeromedical aspects of mishap investigation.

To provide consultation services, based on research data, to the FAA, NTSB, other government agencies, and other non-governmental organizations nationally and internationally.

11. Technical Summary:

Epidemiological methods and database technology will be applied to aircraft mishap data to examine possible roles of medical factors or stresses of flight that might lead to sudden or subtle incapacitation due to such aeromedical abnormalities as (sudden) heart attack in-flight or aeromedical alterations such as (subtle) spatial disorientation.

A national program of data flowing from the FAA regions to CAMI provides quality assurance, collation, and database entry by the Aircraft Accident Research and other CAMI teams. Using mortality and morbidity data from autopsy and accident reports, a database related to cause of death and associated injuries has been created for use in aviation safety enhancement. The tracking of pilot incapacitations permits the centralized creation of incapacitation and impairment incidence data for the National Airspace System. Special medical issuance pilot mishaps are tracked to provide data to medical certification authorities to ensure rapid outcome analysis. Partnering with industry has ensured that data from in-flight medical events are entered into a medical kit utilization database to assist with questions regarding the contents and optimal functioning of the mandated in-flight medical kits. Data collection is coupled with monthly meetings in association with the Aeromedical Certification Division to permit rapid exchange of information about recent aeromedical event occurrences.

Participation in mishap investigation provides for the collection of information about aircraft crashworthiness and cabin safety aspects relating to aircraft evacuation. Information obtained from NTSB investigations (autopsies, toxicological reports, interviews, flight data records (FDRs)) are correlated to determine the predominant bioaeronautical factors in the cause of injuries/deaths, the effectiveness of evacuation systems, the effectiveness of medical equipment onboard civilian aircraft, and post-impact crashworthiness. Accident and incident site participation at the request of the FAA Office of Accident Investigation is a critical facet of this research. Select in-house research on other clinical and bioaeronautical factors is accomplished to enhance the understanding of accident/incident scenarios and to develop aeromedical guidance materials for regulators, pilots, and investigators.

12. Resources Requirements:**FY01****FY02****FY03****FAA Staff Years****11****11****11****13. Description of Work:****(1) Brief Background**

The Aircraft Accident Research and Vision Research Teams established at CAMI are leading edge consult and research units employing a wide range of disciplines which are used in virtually all major air disasters. Numerous reviews regarding in-flight sudden incapacitation, medical kit utilization patterns, and special issuance pilot mishaps have been conducted. Special skills in the determination of situational awareness, specifically spatial disorientation, have been useful in the causal determination of aviation accidents. Many outreach activities have occurred to disseminate the research findings at aviation safety meetings nationally and internationally.

The projects will examine the following concepts and/or null hypotheses:

- (i) Commercial airmen who experience an incapacitation will not differ from the general airmen population, analyzed for a variety of descriptors;
- (ii) Special issuance pilots have a similar mishap rate experience compared to pilots overall;
- (iii) Part 121 aviation medical kit contents are effective in dealing with most serious in-flight medical emergencies;
- (iv) Automated external defibrillators (AED's) are effective in dealing with symptomatic cardiac dysrhythmias, including ventricular fibrillation in-flight;
- (v) Injury patterns and medical conditions found in autopsies can be used to provide descriptive information to enhance medical certification and aerospace safety;
- (vi) Corrective procedures for glare, ocular surgeries, and refractive error correction have no negative effect on optimum pilot performance;
- (vii) There is no increased risk of an aviation accident from high intensity light sources at laser light shows and sports stadiums using the present FAA regulations.

The research will incorporate investigation of selected accidents at the request of AAI and the NTSB. The team's emphasis is on those factors associated with bioaeronautical performance concerns, such as in-flight incapacitation or impairment. The effect of glare on vision performance will be evaluated in both normal and visually compromised test subjects under conditions of actual and/or simulated flight conditions. Epidemiological research will rely on regular updating of the various databases created by this research effort. An advanced, fully integrated database system will be developed. CAMI will work with governmental, industry, and academic partners using voluntary and contract agreements to broaden CAMI's information gathering and dissemination capabilities.

14. Intended End Products / Deliverables:**Note: Many of the outcomes tracked within this research program are rare catastrophic events requiring lengthy follow up.**

- (1) By the end of the year 2000 provide a report on the results of in-flight medical kit utilization.
- (2) By the end of the year 2001 establish an advanced, integrated, and customer friendly bioaeronautical database.
- (3) By the year 2001 provide a report on the utilization of automated external defibrillators in aircraft.
- (4) By the year 2002 provide a report on the mishap experience of pilots with special medical circumstances.
- (5) By the year 2003, provide improved information regarding the common causes of death in aircraft accidents with respect to the most common operations of aircraft within the NAS.
- (6) By the year 2005, review the accidents and incidents due to medical incapacitation of crew and provide a report and recommendations.
- (7) By the year 2005 provide a report on the causes of death and the injury patterns of passengers to provide data for cabin safety improvement initiatives.
- (8) Establish an international standard/ recommended practice that regulates laser light sources.

Provide guidance material to international countries for the development and implementation of regulations on laser emitters and flight safety.

15. Schedules / Milestones:

	FY01	FY02	FY03
Respond to all AAI/NTSB requests for analytical assistance	Continuous	Continuous	Continuous
Evaluate accident research data for injuries and medical conditions, which may be affected by aircraft configuration or medical certification	Continuous	Continuous	Continuous
Development of an advanced bioaeronautical database	Q4	Continuous	Continuous
Initial report of autopsy data	Q1		
Development of CAD/CAM accident database with TSB-Canada Protocol Interim report Forensic product	Q4	Q2	Q1
Categorizations of pilot incapacitations Influence of changes in medical certification standards – data			Q3
Evaluation of mishap experience of special medical certificated pilots Protocol Data Collection Report	Q2	Q1	Q1
Report of MedAire emergency medical kit evaluation	Q1		
Aviation Medical Assistance Act in-flight death study Report	Q1		
Evaluation of SODA pilots*	(*will begin after transition to a new medical certification process is complete)		
Data collection Guidelines manual	Q3	Q1	
Comparison of pilot medication usage with toxicology findings* Protocol Data collection Report	Q1	Q2	Q3
Final draft completed of ICAO Standard and Recommended Practice (SARP) and "Manual on Laser Emitters and Flight Safety"	Q2		
Publication of the SARP and Manual in the ICAO Annex		Q2	

16. Procurement Strategy / Acquisition Approach / Technology Transfer:

Procurements anticipated in FY-01 follow standard acquisition strategies.

Develop an advanced, integrated, user friendly Bioaeronautical Database: 150K

17. Justification / History:

This research program is mandated by Congress in the Aviation Research Act of 1988 and of Public Law 103-272, the FAA Act. Several projects have reportables mandated by Congress in the Aviation Medical Assistance Act of 1998(PL 105-170). This project responds to the requirements of FAA Order 8025.1B of February 16, 1984 (and modifications) which establishes the responsibilities of the Office of Aviation Medicine (OAM) to administer a program to investigate the bioaeronautical causes of aircraft accidents. The FAA reports on accident investigation (July 1988, Office of Program and Resource Management, and the OAM) strongly recommended improved medical support of aircraft accident investigations. This project is in compliance with PUBLIC LAW 100-591 (H.R.4686); November 3, 1988. This project is coordinated with the FAA Research, Engineering, and Development (RE&D) Plan, and directly supports the Bioaeronautics portion of the National Plan for Civil Aviation Human Factors.

18. Issues:

Select performance testing that requires human subject testing will incorporate separate protocols reviewed by the CAMI Institutional Review Board (IRB).

19. Transition Strategy:

Not applicable.

20. Impact of Funding Deferral:

There would be no FAA medical link in the investigation, determination and research of bioaeronautical factors and aircraft crash survivability to improve aircraft safety using lessons learned from past accidents. There would no longer be a readily accessible aeromedical consultation service provided by CAMI to operational organizations within the FAA (AAI, AGC), and to other groups such as the NTSB, industry, academia, non-government organizations, or the public. It would be impossible to comply with PUBLIC LAW 100-591 (H.R. 4686); November 3, 1988 that mandates CAMI medical accident investigation. The Aviation Accident Consolidated Database, used previously for several FAA studies such as the "Age 60" and "DUI/DWI" projects, would not be available to complete new studies involving the impact of FAA regulations on aviation safety and the aerospace industry. This could cause a significant increase in liability claims against the government.

21. R&D Teaming Arrangements:

Coordination will be carried out with the Office of Accident Investigation (AAI), the Office of the Chief Counsel (AGC), the Office of Aviation Medicine (AAM), and the National Transportation Safety Board (NTSB). AAI represents the primary sponsor, and AAM, AGC, and NTSB, the primary users, for this research.

22. Special Facility Requirements:

Existing facilities and personnel of the Aircraft Accident Research and Vision Research Teams currently meet requirements for this project.

23. Approvals (Signature Authority):

		Performing Organization	
Steven B. Wallace, AAI-1	Date	Name: William E. Collins, Ph.D. Title: Director, FAA Civil Aeromedical Institute, AAM-3 Date:	
Nancy C. Lane, AIR-3	Date		
Jon L. Jordan, M.D., AAM-1	Date		